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For: CATHODE FOR ELECTRON TUBE HAVING NEEDLE-SHAPED CONDUCTIVE MATERIAL AND METHOD OF PREPARING THE CATHODE (as amended)

TRANSMITTAL OF CERTIFIED TRANSLATION

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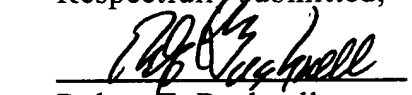
Sir:

Accompanying this transmittal is a certified English language translation of Japanese Patent Publication No. 53-91562 published to Nakanishi on the 11th of August 1978.

Respectfully submitted,



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DECLARATION FOR TRANSLATION

As a below named translator, I hereby declare that:

My residence and citizenship are as stated below next to my name.

I hereby certify that I am conversant with both the English and Japanese language and that enclosed herewith is a true and accurate English translation of the Japanese Patent Publication No. 53-91562 published on the 11th of August 1978 document.

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Title

OXIDE CATHODE

Claims

(1) Oxide cathode which comprises base metal, electron radioactive material mounted on the base metal, and needle-shaped carbons placed within the electron radioactive material.

(2) Oxide cathode of claim 1, wherein carbonate is used as the electron radioactive material.

Detailed Description of the Invention

The present invention relates to an oxide cathode used in an electron tube and, particularly to an oxide cathode wherein improvement has been made on activation of oxide.

Oxide cathode of the invention works in such a way that, carbonate such as alkaline soil is pasted on base metal, carbonate is heat-decomposed into oxide, and later, during the activation process on reducing agent, which is pre-contained in the base metal, and oxide, free atoms are generated from oxide, and electrons are emitted as an emission donor. Carbonate can be a unit or multi-units. For the sake of convenience, since the basic idea of activation is the same for both a unit and multi-units, a unit is used throughout the detailed description set forth below.

Barium carbonate ($BaCO_2$) is combined with resin solution, such as nitrocellulose

dissolved in organic resolution, sprayed, and pasted on the base metal by electrodeposition or by painting. Nickel is used for the base metal and Mg, Bi, Al, Zr and W, *etc.*, are pasted, either alone or in combination, as reduction agent.

Figure 1 shows an example of conventional construction of oxide cathode. Cathode tube (2) which consists of barium carbonate layer (1) pasted on the tube and the base metal is designed to be heated by a heater (3). This type of oxide cathode is placed within the electron tube, and goes through the process of air exhausting process, which is to make the tube vacuumed. During this process, cathode is heated by the heater to 1000 °C, and barium carbonate is heat-decomposed as following equation (1).

$$BaCo_2 \rightarrow BaO + CO_2 \quad \ldots\ldots (1)$$

Carbon dioxide (CO_2) generated by this reaction is discharged to the outside the electron tube. At the same time, resin, such as nitrocellulose is heat-decomposed into gas, and is also discharged to the outside the electron tube with carbon dioxide.

After this reaction, barium carbonate layer (1) transforms into oxide barium (BaO). This BaO reacts, at the contact point with the base metal, with said reduction agent, and generates free barium (Ba). The reaction with the reduction agent is expressed as the following equation (2):

$$BaO + Mg \rightarrow Ba + MgO \quad \ldots\ldots (2)$$

This free barium (Ba), as an emission donor, involves in electron emission.

As described above, the emission donor is formed on the surface where oxide layer and base metal contact, and moves the oxide layer and comes out to the surface of the oxide layer and emits electrons. Since this free barium evaporates or dissipates when it reacts with residual

gas within the electron tube, it is necessary to supply free barium by performing equation (2). It is therefore the disadvantage of the conventional oxide cathode in that, the conventional oxide cathode needs to be used at the high temperature, usually around 800 °C, and it produces mere 2.5 A/cm^2 maximum of electron emissive electricity. The present invention overcomes this disadvantage by planting a cluster of needle-shaped carbons with strong reducing power inside electron emissive material.

Referring now to Figure 2, Figure 2 is a cathode tube 2 wherein carbon needles (needle-shaped carbon) 4 are implanted on the carbonate of the cathode tube 2 which is made of substrate metal, and carbon needles 4 are berried within the carbonate layer 5 in the cathode tube.

The method of implantation are not limited by this invention. Carbon needles 4 are berried within the carbonate layer 5 by a typical method.

In this regard, carbonate is used in this invention as electron radioactive substance, but the material is not limited to carbonate. In addition, it can be either a unit or a multi-units.

The cathode which is constructed as indicated above, reduces and activate carbonate by a general method. During these processes, the following advantages can be found. In order to increase understanding barium carbonate ($BaCO_2$) is used in this invention. The heat resolution of barium carbonate ($BaCO_2$) can be done by a general method, and is transformed into barium oxide (BaO) as indicated by equation (1).

At the cathode of the present invention, barium carbonate ($BaCO_2$) also reacts with carbon C of carbon needles 4, and is transformed into barium oxide (BaO) as indicated by equation (3).

$BaCo_2 + C \rightarrow BaO + 2CO$ ..... (3)

This is to say, as an advantage, at the cathode of the present invention, resolution of barium carbonate ($BaCO_2$) is accelerated by carbon needles 4.

The transformed barium oxide (BaO) produces free barium (Ba) by equation (2) and, at the same time, reaction between carbon needles and barium oxide (BaO) is taken place as shown by equation (4).

$BaO + C \rightarrow Ba + CO$ ..... (4)

As reduction power of carbon is so large that the reaction indicated by equation (4) produces a large quantity of free barium (Ba). In addition, by this invention, since carbon is shaped like needles and the carbon needles are implanted within the barium oxide layer, the contact area for barium oxide (BaO) and carbon needles is large. Furthermore, since the distance between the surface area of the layer and the carbon needles are arranged to be close to each other, the moving distance of free barium is short. These features makes replenishment quiet easy.

As described above, this invention overcomes the disadvantages exhibited by the conventional oxide cathode by simply planting a cluster of needle-shaped carbons on the base metal. This will lower the temperature with which oxide cathode acts, produces greater amount of electricity, and shorten the decomposition and activation process times.